

WHAT IS CLAIMED IS:

1. A medical system comprising:

a carrier;

a multiplicity of electromechanical transducers mounted to said carrier, said transducers being disposable in effective pressure-wave-transmitting contact with a patient;

energization means operatively connected to a first plurality of said transducers for supplying same with electrical signals of at least one pre-established ultrasonic frequency to produce first pressure waves in the patient; and

a control unit operatively connected to said energization means, said control unit including an electronic analyzer operatively connected to a second plurality of said transducers for performing electronic 3D volumetric data acquisition and imaging of internal tissue structures of the patient by analyzing signals generated by said second plurality of said transducers in response to second pressure waves produced at said internal tissue structures in response to said first pressure waves, said control unit including phased-array signal processing circuitry for effectuating an electronic scanning of the internal tissue structures to facilitate electronic 3D volumetric data acquisition.

2. The system defined in claim 1 wherein said carrier is rigid.

3. The system defined in claim 2 wherein said carrier comprises a plurality of rigid

8. The system defined in claim 7 wherein said means for varying includes switching circuitry.

9. The system defined in claim 1 wherein said second plurality of said transducers includes transducers different from the transducers in said first plurality of said transducers.

10. The system defined in claim 1 wherein said control unit includes circuitry operatively connected to said energization means for varying said frequency to facilitate collection of three-dimensional structural data pertaining to tissue structures at different depths in the patient.

11. The system defined in claim 1 wherein said carrier is provided with at least one chamber for holding a fluid, said transducers being in pressure-wave communication with said chamber, thereby facilitating pressure wave transmission from said first plurality of said transducers to the patient and from the patient to said second plurality of said transducers.

12. The system defined in claim 1, further comprising at least one display operatively connected to said analyzer for providing an image of said internal tissue structures of the patient.

13. A medical method comprising:

providing a carrier holding a multiplicity of electromechanical transducers;

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The first part of the paper is devoted to the study of the asymptotic behavior of the solutions of the system (1) for large values of the parameter ϵ . It is shown that the solutions of the system (1) for large values of ϵ are close to the solutions of the system (2). The second part of the paper is devoted to the study of the asymptotic behavior of the solutions of the system (1) for small values of the parameter ϵ . It is shown that the solutions of the system (1) for small values of ϵ are close to the solutions of the system (3).

18. The method defined in claim 13 wherein said carrier is rigid, further comprising disposing a flexible fluid-filled bag between the patient and said carrier and transmitting said first pressure waves and receiving said second pressure waves through said fluid filled flexible bag

20. The method defined in claim 13, further comprising generating an image of the internal tissues of the patient on at least one display.

the receiving, via said second plurality of said transducers, of said second pressure waves;

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medical system comprising:

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s in response to second pressure waves, said control unit including

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coherent aperture combining circuitry for coherently combining structural data from the respective apertures, said position determination or calibration means including circuitry for executing a self-cohering algorithm (a) computing relative positions and orientations of said substrates using instantaneous position measurements and (b) adjusting signals from coherently combined apertures to enable constructive addition of said signals from said coherently combined apertures.

27. The system defined in claim 25 wherein said position determination or calibration means includes means for executing computations according to a self-cohering algorithm.

28. The system defined in claim 24 wherein said position determination or calibration means includes programmed componentry operatively connected to said energization means for periodically energizing at some of said transducers with at least one predetermined electrical frequency and calculating instantaneous positions of the transducers so energized.

29. The system defined in claim 23, further comprising at least one display operatively connected to said analyzer for providing an image of said internal tissue structures of the patient.

30. The system defined in claim 23 wherein said substrates are connected to one another via a flexible linkage so that said substrates are extendable at a variable angle with respect to one

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another.

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31. A medical method comprising:

providing a carrier holding a multiplicity of electromechanical transducers defining respective data gathering apertures;

placing said carrier and a patient adjacent to one another so that said transducers are disposed in effective pressure-wave-transmitting contact with the patient;

supplying a first plurality of said transducers with electrical signals of at least one pre-established ultrasonic frequency to produce first pressure waves in the patient;

receiving, via a second plurality of said transducers, second pressure waves produced at internal tissue structures of the patient in response to said first pressure waves; and

performing electronic 3D volumetric data acquisition and imaging of said internal tissue structures by analyzing signals generated by said second plurality of said transducers in response to said second pressure waves,

at least one of the steps of supplying and receiving including coherently combining structural data from the respective apertures.

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32. The method defined in claim 31 wherein said carrier includes a plurality of rigid substrates and wherein the step of coherently combining includes determining relative positions and orientations of said substrates relative to one another.

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33. The method defined in claim 32 wherein each of said substrates is provided with a plurality of point scatterers, the determining of relative positions and orientations of said substrates including periodically scanning said point scatterers with ultrasonic pressure waves and calculating instantaneous positions of said point scatterers.

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34. The method defined in claim 33 wherein the determining of relative positions and orientations of said carriers includes executing computations according to a self-cohering algorithm.

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35. The method defined in claim 32 wherein the determining of relative positions and orientations of said carriers includes periodically energizing at some of said transducers with at least one predetermined electrical frequency and calculating instantaneous positions of the transducers so energized.

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36. The method defined in claim 35 wherein the determining of relative positions and orientations of said carriers includes executing computations according to a self-cohering algorithm.

37. A medical scanning apparatus comprising:

a plurality of 1.5D transducer arrays rigidly connected to one another; and
phased-array signal processing circuitry operatively connected to said 1.5D transducer

$\Gamma_{\text{eff}}^{(2)} = \Gamma_{\text{eff}}^{(2)} + \Gamma_{\text{eff}}^{(2)}$

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41. The method defined in claim 40 wherein said pulses are transmitted in respective
ent directions into the patient.

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